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Forest Health Report

New England and New York
1990

NORTHEASTERN AREA
State and Private Forestry
Forest Health Protection
USDA Forest Service
Durham, NH

FOREST HEALTH REPORT
NEW ENGLAND AND NEW YORK
1990

by Florence Peterson and Susan Cox

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PREFACE

The current emphasis on forest health encourages us to shift our view to the forest as a resource and to the health of the forest as a whole. This report is directed towards reporting forest conditions with more awareness of the resource. Future reports will move further in this direction and will include more information on factors such as fire, weather, climate, and pollution. This report was compiled from information provided by State Cooperators and USDA Forest Service Inventory and Analysis with additional information from Forest Health Protection surveys and cooperative projects.

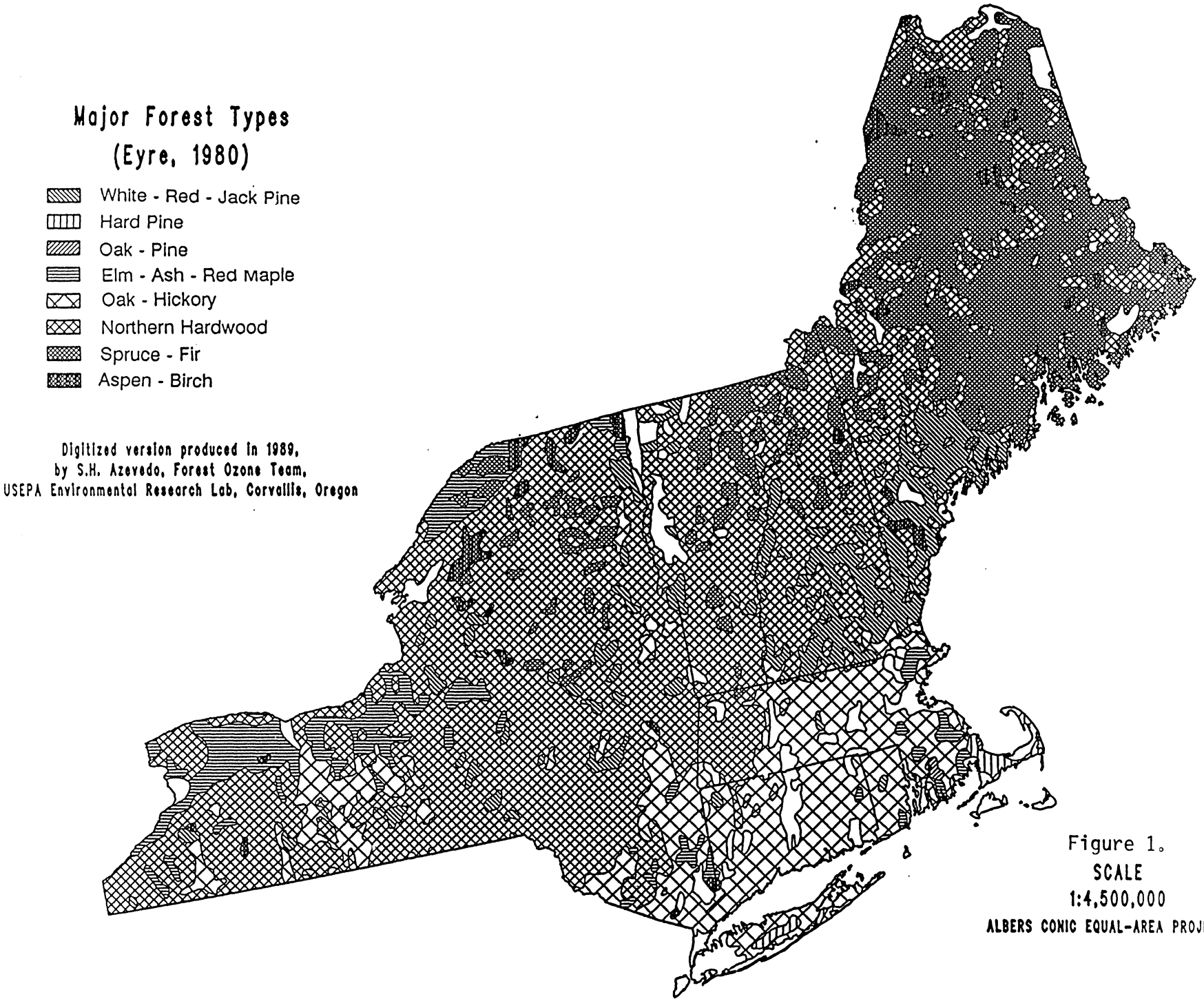
Major Forest Types
(Eyre, 1980)
White - Red - Jack Pine
Hard Pine
Oak - Pine
Elm - Ash - Red Maple
Oak - Hickory
Northern Hardwood
Spruce - Fir
Aspen - Birch
Digitized version produced in 1989,
by S.H. Azevedo, Forest Ozone Team,
USEPA Environmental Research Lab, Corvallis, Oregon
SCALE
1:4,500,000
ALBERS CONIC EQUAL-AREA PROJECTION

Figure 1.

THE FOREST RESOURCE

The New England/New York region is comprised of 70.559 million acres, 72% of which is forested. Ninety-one percent of the forested land is considered commercial timberland with the remaining being productive reserved forest land and unproductive land (noncommercial) (Table 1).

Forest type is defined as "a classification of forest land based on the species forming a plurality of live tree stocking." The many forest types in New England and New York are organized by the U.S. Forest Service, Forest Inventory and Analysis, into forest type groups (Figure 1). These groups are white/red pine, spruce/fir, hard pine, oak/pine, oak/hickory, elm/ash/red maple, northern hardwoods, and aspen/birch.

Within the commercial forest area, 43% is in the northern hardwood forest type group, 21% in the spruce/fir forest type group, 10% in the oak/hickory forest type group, and the remaining 26% in the other five forest type groups that comprise the region. No current figures are available for noncommercial forested areas (Table 2).

New England/New York Forest Type Groups

Spruce/Fir: Forests in which red, white, black, or Norway spruce, balsam fir, northern white cedar, tamarack or planted larch, singly or in combination, comprise a plurality of the stocking. Common associates are white pine, red maple, yellow birch, paper birch, aspen, hemlock and, sugar maple. Most of the spruce/fir type group is found in northern New England, northern New York, and in the higher elevations of the Berkshire and Catskill mountains.

White/Red Pine: Forests in which white pine, red pine, or hemlock, singly or in combination, comprise a plurality of the stocking. Common associates are red maple, sugar maple, oak, aspen, red spruce, balsam fir, and paper birch. The white/red pine group is found along the coast of New Hampshire and Maine, and in scattered pockets throughout New England and New York.

Hard Pine: Forests in which pitch pine, or eastern red cedar, singly or in combination, comprise a plurality of the stocking. Common associates are white pine, paper birch, sugar maple, basswood, oak, and hickory. The hard pine type groups are found mostly on sandy soils in southeast Massachusettes, southern New Hampshire, southern Maine, and New York.

Oak/Pine: Forests in which hardwoods (usually hickory or oak) comprise a plurality of the stocking, but where white pine, or eastern red cedar comprise 25 to 50% of the stocking. Common associates are beech and sugar maple. This type group is mostly found in old fields and is intermittent throughout the region.

Oak/Hickory: Forests in which upland oaks, hickory, yellow poplar, black locust, sweetgum, or red maple (when associated with central hardwoods), singly or in combination, comprise a plurality of the stocking, and in which hard pines or eastern red cedar comprise less than 25% of the stocking. Common associates are white ash, sugar maple, hemlock, white pine, paper birch, beech, balsam fir, poplar, and elm. This type group is found mostly in southern New England, central New York, and intermittently throughout the rest of the region.

Elm/Ash/Red Maple: Forests in which elm, willow, cottonwood, black ash, or red maple (when growing on wet sites), singly or in combination, comprise a plurality of the stocking. Common associates are white ash, sugar maple, aspen, oaks, balsam fir, northern white cedar, beech, white pine, and basswood. This type group is found mainly along the Great Lakes, St. Lawrence River, river valleys, and alluvial flats. These stands are sometimes referred to as swamp or lowland hardwoods.

Northern Hardwoods: Forests in which sugar maple, beech, yellow birch, black cherry, or red maple (when associated with northern hardwoods), singly or in combination, comprise a plurality of the stocking. Common associates are white ash, hemlock, basswood, aspen, red oak, balsam fir, red spruce, paper birch, sweet birch, white birch, white pine, and elm. This type group is found mostly in New York, Northern New England, and western Massachusettes on loamy well drained soils.

Aspen/Birch: Forests in which aspen, paper, or gray birch, and pin cherry, alone or in combination comprises a plurality of the stocking. Common associates are red maple, poplar, white pine, red oak, white ash, balsam fir, red spruce, and white spruce. This type group is comprised of the pioneer forest types that revegetate abandoned farms and areas disturbed by fires and is found intermittently throughout New England and New York.

Land Classes

Timberland: Forest land producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and not withdrawn from timber utilization.

Noncommercial forest land: Productive reserved, urban, and unproductive forest land.

Productive reserved forest land: Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas tree production.

Urban forest land: Noncommercial forest land within urban areas that is completely surrounded by urban development (not parks), whether commercial, industrial, or residential.

Unproductive forest land: Forest land that is incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions, because of adverse site conditions.

Nonforest land: Land that has never supported forests, or land formerly forested but now in nonforest use such as cropland, pasture, residential areas, and highways.

Table 1. Land area by land class and state (in thousands of acres).

State	Timberland	Noncommercial Forest	Non-Forest	Total
ME	17,060	547	2,229	19,837
NH	4,812	175	768	5,756
VT	4,422	122	1,390	5,935
MA	2,929	296	1,782	5,008
RI	372	33	270	675
CT	1,777	48	1,292	3,118
NY	15,406	3,100	11,729	30,235
Total	46,778	4,321	19,460	70,559

Table 2. Timberland area by state and forest type group (in thousands of acres).

State	Spruce/ Fir	White/ Red Pine	Hard Pine	Oak/ Pine	Oak/ Hickory	Elm/ Ash/ Red Maple	Northern Hard-wood	Aspen/ Birch	Total
NY	755	1,569	86	91	1,888	907	9,331	778	15,405
VT	634	631	0	13	164	99	2,698	183	4,422
NH	678	1,356	41	100	395	32	2,004	206	4,812
ME	7,771	2,195	8	36	307	238	5,001	1,505	17,060
MA	37	776	112	257	917	125	671	34	2,929
CT	14	166	19	48	966	130	434	0	1,777
RI	0	17	13	30	256	23	27	6	372
Total	9,889	6,710	279	575	4,893	1,554	20,166	2,712	46,777

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FOREST STRESSORS

CONDITIONS IN BRIEF

The pest causing the most widespread damage throughout the New England/New York region in 1990 was the gypsy moth. A total of 7,304,294 acres were defoliated. Rhode Island was the only state not affected. The pathogen, *Entomophaga maimaiga*, caused significant larval mortality in several states. Damage from pear thrips increased in Vermont, particularly in northern areas. Thrips injury was also reported in Maine, New York, and Rhode Island. Defoliation from saddled prominent continued in New York, Massachusetts, and Vermont, occurring on more than 100,000 acres. A fungal pathogen caused a collapse in larval activity in all three states. Spruce beetle continued to infest mature spruce in portions of Maine, causing 50% mortality to large white spruce in some areas. Rising populations of hemlock looper threaten hemlock, balsam fir, and white spruce in Maine. Looper populations were also reported in Vermont and Connecticut. Hemlock woolly adelgid spread in southeastern New York, Connecticut, and Rhode Island. A small population was reported in Massachusetts, and infested tublings were planted and subsequently eradicated in Vermont. Cherry scallop shell moth appeared after a decade or two of latency, causing damage to cherry species in Vermont, New Hampshire, Massachusetts, and New York. Several pests, including Bruce spanworm, fall cankerworm, forest tent caterpillar, oak leaftier, and spruce budworm remain at endemic levels.

No major new disease activities were reported in 1990. Beech bark disease and anthracnose on dogwood and other hardwoods continued to be significant problems. Annosus and armillaria root rots continued to be reported from Vermont and Maine. Diplodia caused damage to red pine in Vermont and Massachusetts. Dutch elm disease continues to attack remaining American elm throughout the region. European larch canker and scleroderris canker did not increase in area but remain under quarantine. White pine blister rust continues to be a problem in some areas of Vermont and Maine.

Dieback of several species occurs throughout the region. Ash dieback and damage from ash yellows occurred in Maine, New York, Massachusetts, and Vermont. Damage to birch continued in Maine but improved in Vermont. Symptoms of dieback in maple were reported, but stands appeared healthier than previous years. Several factors contribute to dieback and decline in larch. The complex includes larch casebearer, larch sawfly, and european larch canker.

Table 3. Major Forest Stressor Occurrence by Forest Type.

Insect	Spruce/ Fir	White/ Red Pine	Hard Pine	Oak/ Pine	Oak/ Hickory	Elm/ Ash/ Red maple	Northern Hard-wood	Aspen/ Birch	Ornamental/ Plantation
Balsam Gall Midge	X								X
Balsam Twig Aphid									X
Browntail Moth									X
Bruce Spanworm					X	X	X		
Cherry Scallop Shell Moth							X	X	X
Fall Cankerworm							X		
Fall Webworm							X		X
Eastern Tent Caterpillar							X		X
Forest Tent Caterpillar							X	X	
Gypsy Moth	X	X	X	X	X	X	X	X	X
Hemlock Looper	X	X			X				
Hemlock Woolly Adelgid					X				X
Larch Casebearer	X								X
Oak Leaftier				X	X				
Pear Thrips							X		
Pine False Webworm		X							X
Red Pine Scale		X							X
Saddled Prominent							X		
Spruce Beetle	X								
Spruce Budworm	X								
White Pine Weevil	X	X							
Pathogens									
Annosus Root Rot									X
Anthracnose					X		X		
Armillaria Root Disease	X	X	X	X	X	X	X	X	X
Beech Bark Disease/Beech Scale							X		
Diplodia Tip Blight									X
Dutch Elm Disease						X			
European Larch Canker	X								
Hypoxylon Canker								X	
Scleroderris Canker	X								X
White Pine Blister Rust		X							
Diebacks/Declines									
Ash Dieback/Yellows					X	X	X	X	
Birch Dieback	X						X	X	
Maple Decline	X	X	X	X	X	X	X	X	X

FOREST STRESSORS

INSECTS

BALSAM GALL MIDGE
Paradiplosis tumifex

Balsam fir is the target of this pest, which is a problem primarily on Christmas tree plantations, although it also occurs in forest stands of the spruce/fir forest type group. Populations in 1990 increased and occurred statewide in Vermont and Maine. Levels in Maine were relatively high, with moderate to heavy damage on 3000 acres. In Vermont, damage was heaviest in northern areas, occurring on 253 acres. Damage was light and scattered in plantations and forest stands throughout the southern part of the state. Suppression projects are keeping the insect under control, and populations are expected to stabilize. Untreated areas may continue to be a problem.

BALSAM TWIG APHID
Mindarus abietinus

Another pest of Christmas tree plantations is the balsam twig aphid. Populations were widespread in Vermont, with damage reported on 424 acres in the northern part of the state. Heavy needle curling occurred on about 80% of the damaged areas. In Maine, 1000 acres were infested with moderate to high damage occurred in some locations. Growers who treated for this insect had few problems.

BROWNTAIL MOTH
Euproctis chrysorrhoea

Several species of shade trees and ornamentals are attacked by browntail moth in coastal areas of Maine and Massachusetts. Those species include willow, oak, cherry, rose, rubus, beach plum, and bayberry. The area of infestation in Maine, previously limited to three Casco Bay islands, has spread to the mainland and increased in intensity. The area now covers more than 40 acres around Freeport and surrounding towns and islands. Severe defoliation was reported on two to three acres on Long Island. The infestation is expected to continue to expand in this state. In Massachusetts, the pest has remained confined to the Cape Cod National Seashore and primarily affects beach plum and bayberry. Attempts at control have been made by clipping winter nests. The population is reported to be stable.

BRUCE SPANWORM
Operophtera bruceata

This pest attacks various hardwoods of the northern hardwood, oak/hickory, and elm/ash/red maple forest type groups. Moderate, localized defoliation was reported on sugar maple in association with pear thrips in southern Vermont, but there was no damage reported elsewhere in the region. Populations in Maine are stable at low, endemic levels.

CHERRY SCALLOP SHELL MOTH

Hydria prunivorata

A sudden eruption of cherry scallop shell moth caused noticeable defoliation to several species of cherry in an area encompassing southern Vermont, southwestern New Hampshire, western Massachusetts, and eastern New York. Black cherry is a major component of the northern hardwood forest type group and pin cherry occurs in aspen/birch. Species of cherry also occur as ornamental and shade trees. Damage was heavy in southern Windham and Bennington Counties in Vermont and in Rensselaer County in New York. Foliage appeared brown and scorched. Damage occurred on 450 acres in Worcester and Berkshire counties in Massachusetts. This insect had been at very low levels since an outbreak in the early 1970's in New York and had not been reported for ten years in Massachusetts. Trends are unknown, but based on past history of the insect, the outbreak may continue for a year or two before parasites and disease reduce the population.

FALL CANKERWORM

Alsophila pometaria

Fall cankerworm is a defoliator of various hardwoods in the northern hardwood forest type group. Damage declined in southeastern Massachusetts from 2,000 acres in 1989 to 800 acres in 1990. The areas affected were Plymouth, Barnstable, and Nantucket Counties. The infestation appears to be moving northward from the original location in Falmouth. Although sometimes occurring in Vermont, the insect was not observed in 1990, and was also reported at low, endemic levels in Maine.

FALL WEBWORM

Hyphantria cunea

A native of North America, the fall webworm attacks hardwood species, shade and fruit trees, and ornamentals. Populations were heavy for the third consecutive year in Maine, occurring statewide, but were heaviest in the central and southwestern part of the state. Damage was primarily aesthetic, with some branch and twig mortality. High populations are expected to continue. The pest was observed throughout Vermont and appears to be expanding. Populations also increased in Massachusetts, covering 400 acres. Defoliation was heavy in Middlesex and Worcester Counties. Further buildup is likely.

EASTERN TENT CATERPILLAR

Malacosoma americanum

Eastern tent caterpillar was found in the northern hardwood forest type group throughout the state of Vermont and into western Massachusetts. This defoliator prefers black cherry, apple, and occasionally other ornamentals and hardwoods. Populations were widespread in 1990, but at lower levels than in the previous two years.

FOREST TENT CATERPILLAR

Malacosoma disstria

Forest tent caterpillar attacks a variety of hardwoods in the northern hardwood and aspen/birch forest type groups. In Maine, it occurred primarily on poplar and in New York, on sugar maple and black cherry. Populations in Maine, Vermont, and New York declined in 1990 to very low levels. No rise in population is expected for 1991. However, a current outbreak in the province of Quebec is causing heavy defoliation and may cause future problems in Maine if there is expansion south or eastward.

GYPSY MOTH DEFOLIATION, 1989-1990

State	1989	1990
	Acres	
District of Columbia	0	10
Delaware	1,888	3,790
Connecticut	78,430	176,576
Massachusetts	950	83,595
Maryland	97,911	133,062
Maine	35,000	270,433
Michigan	294,344	358,338
New Hampshire	18,395	133,200
New Jersey	137,310	431,235
New York	421,138	354,162
Ohio	0	115
Pennsylvania	1,506,790	4,357,700
Rhode Island	0	0
Vermont	27,335	63,000
Virginia	289,332	594,000
West Virginia	86,736	345,078
Totals	2,995,559	7,304,294

Data obtained from GMDIGEST, Morgantown, WV (11/90)

Table 3.

GYPSY MOTH

Lymantria dispar

The gypsy moth is a major forest pest in New England and New York, occurring in virtually all forest type groups. Oaks are preferred, but gypsy moth will also feed on a variety of hardwoods and some conifers. Gypsy moth populations continued their explosive trend throughout most of the region in 1990. The area of defoliation increased dramatically in most New England states, decreasing slightly in New York. No infestation was reported in Rhode Island (Table 3). The pest spread through eastern and southern Maine, causing heavy defoliation on 141,550 acres, moderate defoliation on 82,475 acres, and light defoliation on 46,512 acres. Mortality was light, but there was a significant degradation of hardwoods and loss of regeneration. Maine populations are expected to spread in 1991. New Hampshire experienced moderate to heavy defoliation on 133,450 acres of state land and 9,980 acres of White Mountain National Forest. Defoliation increased in Vermont, covering 60,770 acres of state land and 3,882 acres on the Green Mountain National Forest. Variable populations and scattered defoliation is expected in 1991. The infestation in Massachusetts increased to 83,597 acres of mostly heavy defoliation. A potential increase in 1991 is indicated by egg mass counts. Connecticut reported a total of 176,576 acres affected. The fungal pathogen, *Entomophaga maimaiga*, caused widespread larval mortality in Vermont, New Hampshire, Massachusetts, and Connecticut. Larvae infected by virus were also detected in New Hampshire. Levels of *E. maimaiga* and viral infections may have a significant impact on the continuation or collapse of gypsy moth populations in 1991 (See figure 2 and 3).

HEMLOCK LOOPER

Lambdina spp.

Hemlock looper, *Lambdina fiscellaria*, and the related species, *Lambdina athasaria*, are defoliators of hemlock, a component of the white/red pine, spruce/fir, and oak/hickory forest type groups. The species look similar and overlap in range. Damage caused by each may be difficult to distinguish. *Lambdina fiscellaria* also commonly attacks balsam fir and white spruce and is becoming an increasing problem in Maine. The area affected by this pest is predominantly the eastern and southeastern part of the state, where damage was heavy on 20,000 acres of hemlock and moderate on 80,000 acres of hemlock and fir. Hemlock mortality was 50% on 300 acres and about 10% on 5,000 acres. Additional mortality is expected in areas of severe damage where hemlock lost 90 to 100% of total needles. A smaller area in southwestern Maine was affected by *L. athasaria*, causing severe defoliation on 1,000 acres with 25% mortality of hemlock and moderate to heavy defoliation on 800 acres with some mortality of smaller trees. Expected trend is a continued increase in area and intensity. Localized defoliation in Vermont occurred on five to ten acres in the Vernon area. Moderate to heavy defoliation was reported on 80 to 100 acres in northcentral Connecticut with an unknown amount of lighter defoliation. Damage was probably due to *L. athasaria*, although not confirmed.

HEMLOCK WOOLLY ADELGID

Adelges tsugae

Populations of hemlock woolly adelgid intensified in southern New England and New York, attacking eastern hemlock, an ornamental, nursery, and forest species. In forest stands, the pest appears to be more prevalent on hemlock associated with oak/hickory but threatens hemlock in other forest type groups as well. The infestation was first reported in Connecticut and increased its presence in 1990 to 14% of the 192 satellite plots monitored by the state. River valleys tend to have the heaviest concentrations. The area of infestation increased in southeastern New York and mortality was moderate to heavy. Adelgid infestation continued in Rhode Island where some locations were reported to be brought under control while new areas appeared. Populations in all three states are expected to continue rising. In Massachusetts, ornamental hemlocks were reported infested on three acres in at least two locations with no mortality. The insect was introduced to Vermont on tublings which were planted then pulled upon detection. Chances for eradication are good since most seedlings were destroyed and hemlock does not occur in the locality of the plantations. Surveys conducted on 162,700 acres of southeastern New Hampshire have yet to show evidence of the pest.

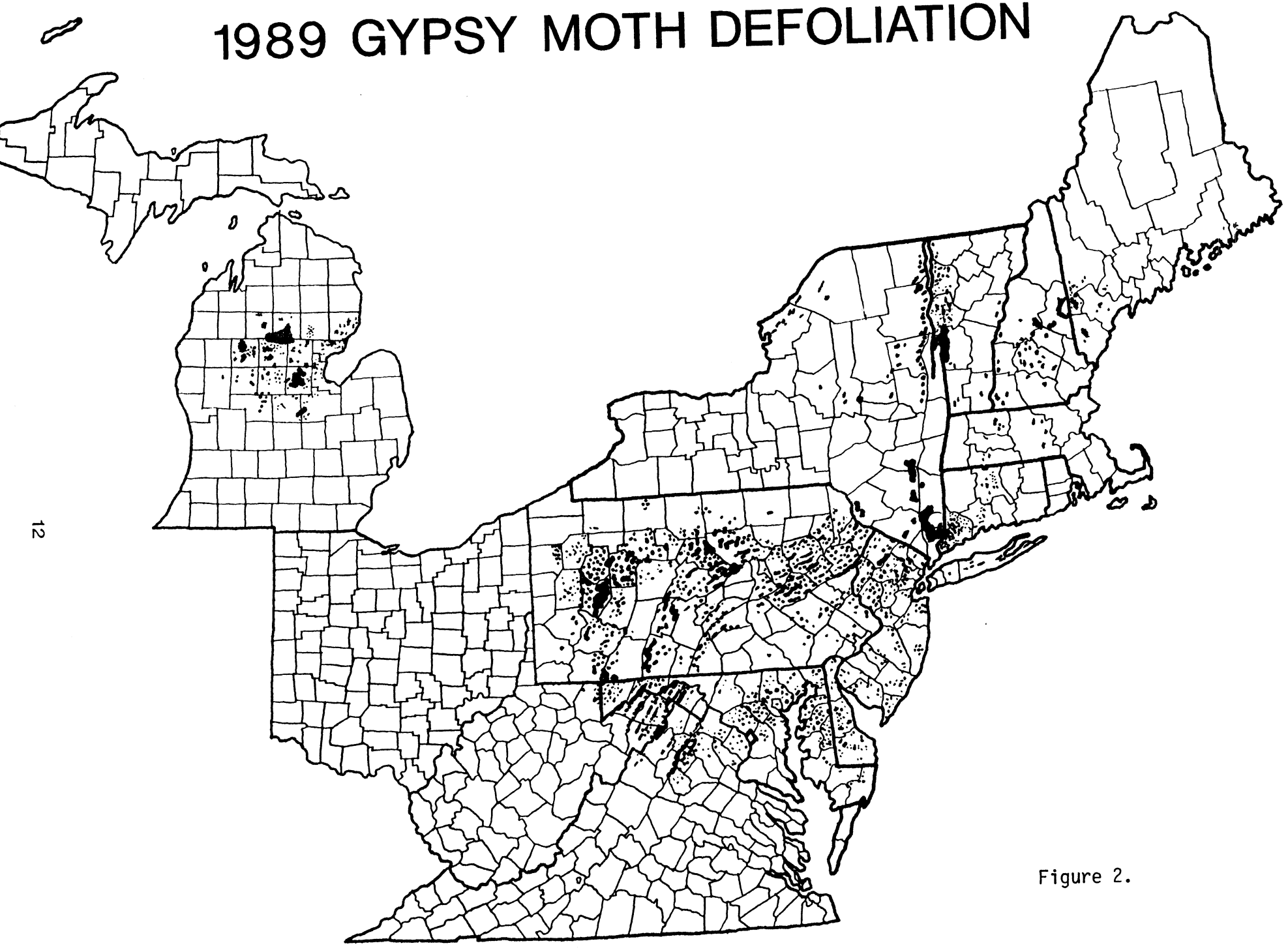

Figure 2.

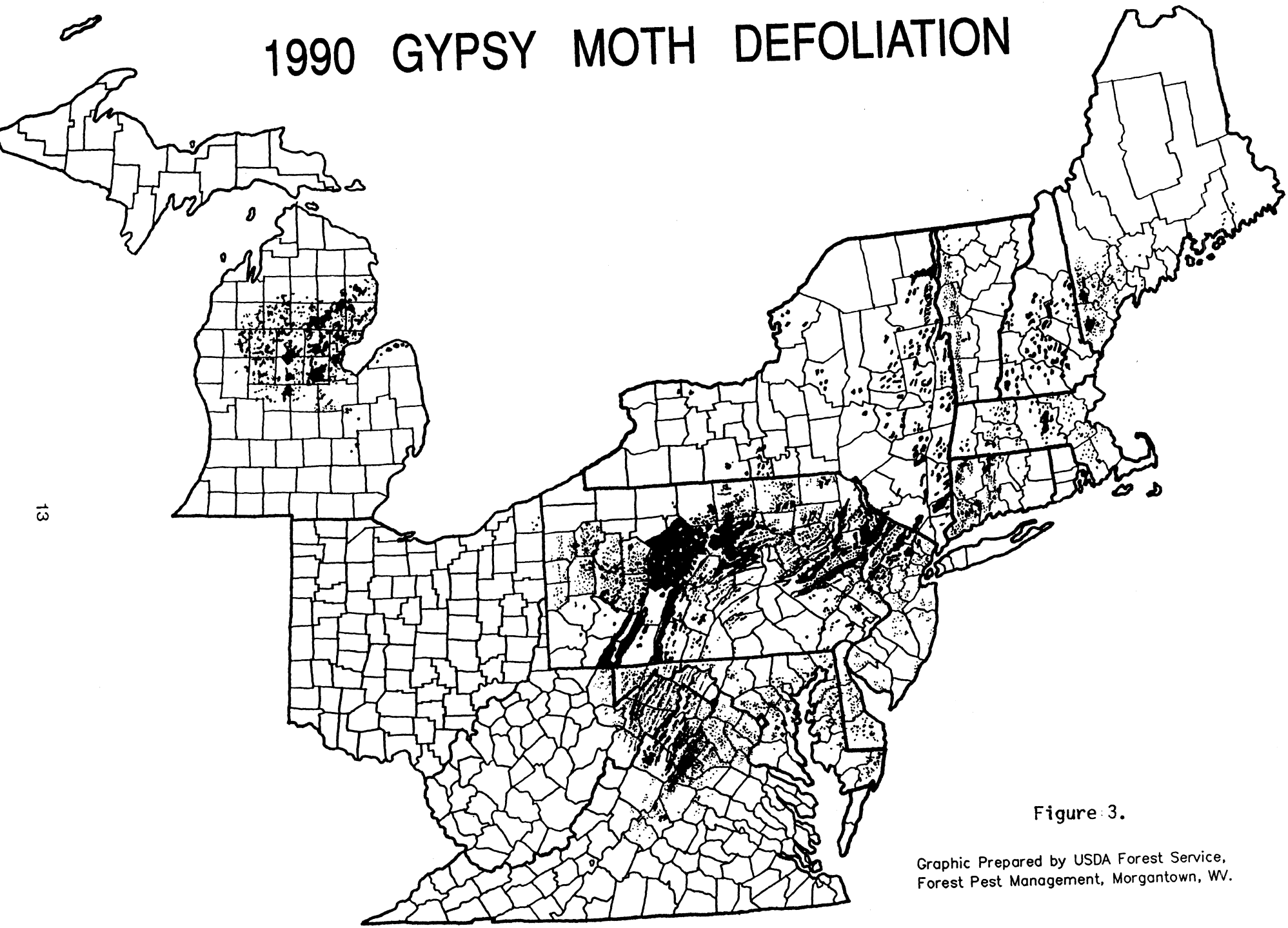

Figure 3.

Graphic Prepared by USDA Forest Service,
Forest Pest Management, Morgantown, WV.

LARCH CASEBEARER

Coleophora laricella

Larch casebearer feeds primarily on tamarack in the northeast, a component of the spruce/fir forest type group and, occasionally, an ornamental. Damage continued at static levels in southern Maine, giving trees a scorched appearance. The infestation increased in northern Vermont. Southern areas of the state sustained less widespread damage with 350 acres of defoliation in Rutland and Bennington Counties. Larch casebearer is one of the components of the complex which contributes to decline symptoms of larch.

OAK LEAFTIER

Croesia semipurpurana

The oak leaftier is a defoliator of red oak, a component of oak/hickory and oak/pine forest type groups. Populations of this pest continued to diminish in 1990 with very low levels reported in Vermont. Levels were also low in New Hampshire, the insect appearing on 16,160 acres in the southwestern part of the state, but no defoliation was observed during aerial survey. The infestation in Massachusetts was reduced to 80,000 acres in Worcester, Norfolk, and Bristol Counties. Defoliation was less than 30 percent.

PEAR THRIPS

Taeniothrips inconsequens

Pear thrips occur in the northern hardwood forest type and predominantly attack sugar maple. Damage from pear thrips increased in 1990 in Vermont. Defoliation was heaviest in northern areas, with 26,773 acres detected by aerial survey. In southern areas, moderate to heavy damage occurred on 3,375 acres in mid- to upper-elevation sites where bud break was delayed and coincided with the emergence of thrips. Scattered areas did not refoliate, and thin crowns and brown leaves were apparent later in the season. Attack from pear thrips also left trees vulnerable to further damage by anthracnose, maple leaf cutter, maple webworm, and maple trumpet skeletonizer. Light injury was observed in southwestern Maine and throughout New York. Approximately 50 acres were affected in Rhode Island where the infestation is growing and expected to expand.

PINE FALSE WEBWORM

Acantholyda erythocephala

Now a relatively common webspinning sawfly, the pine false webworm originated in Europe and was first found on this continent in Pennsylvania. It is a pest of economic importance to Christmas tree growers, defoliating red, white, and scotch pine on plantations and forest stands within the white/red pine forest type group. In New York, populations increased to cover an area of 4,400 acres in the northwestern Adirondacks. Damage was moderate to heavy. Additional acreage is expected to become infested.

RED PINE SCALE

Matsucoccus resinosae

A problem of red pine, which occurs in the white/red pine forest type group and in plantations in New York, Connecticut, and Rhode Island, is red pine scale. Initial detection is difficult, but large populations cause severe stress, crown damage, and mortality. The infestation in New York comprises several counties in the southeastern part of the state, including all of Long Island. Mortality occurs throughout the area, and insect populations are declining due to lower numbers of host trees. Scale populations in Rhode Island increased and caused heavy defoliation on 120 acres in the Charlestown area. Conditions are expected to remain severe. Attempts to control the insect through timber salvage have been made in New York and Rhode Island.

SADDLED PROMINENT

Heterocampa guttivitta

All the major components of the northern hardwood forest type group, sugar maple, beech, yellow birch, and black cherry, are hosts of the saddled prominent. Moderate defoliation covered 100,000 acres in Delaware County, NY, a decline from the explosive outbreak of 1989. Defoliation occurred for the second year in Massachusetts and was moderate to heavy on 1,488 acres in Berkshire County. Populations increased in southern Vermont with 2,875 acres affected. All three states reported a collapse due to a fungal pathogen, and little damage is expected in 1991.

SPRUCE BEETLE

Dendroctonus rufipennis

Mature red, white, and occasionally black spruce, all components of the spruce-fir forest type group, are subject to attack from spruce beetle in Maine. The infestation has increased over the past several years and now occupies much of the northern part of the state. Stands previously attacked by spruce budworm have been particularly susceptible. In 1990, an area of over 9,000 acres was severely infested with more than 25% of the spruce affected, and 50% mortality in white spruce over 15 inches in diameter. Attempts have been made to salvage heavily infested stands while the timber is still marketable. Damage in some areas may have peaked, but trends show new areas may be affected.

SPRUCE BUDWORM

Choristoneura fumiferana

Populations of spruce budworm, a pest of the spruce/fir forest type group, have collapsed to endemic levels. There was no visible defoliation in Vermont or New Hampshire. In Maine, damage was minimal and confined to the southeast coast, the most recent outbreak area. Populations are expected to remain at low levels.

WHITE PINE WEEVIL

Pissodes strobi

Target species of the white pine weevil are components and associates of the spruce/fir and white/red pine forest type groups as well as common plantation trees. White, Scotch, and Jack pine and red, white, Norway, and blue spruce are all affected. The infestation in Maine spanned 418,900 acres statewide. There was significant reduction in growth reported and loss of sawlog quality trees. Damage is expected to continue but not greatly increase. In Vermont, the weevil continued to cause widespread terminal shoot mortality, a particular problem within Christmas tree plantations. Damage levels were less severe than in 1989 in the northern part of the state.

FOREST STRESSORS

PATHOGENS

ANNOSUS ROOT ROT

Heterobasidion annosum

Annosus root rot is common in North American coniferous forests but in the northeast is usually found in red pine plantations. One thousand acres of red pine plantations in Maine have been affected with total mortality amounting to 25 acres. Infestations are expected to increase gradually. Several infection sites in an overstocked stand have been observed in Guilford, Vermont.

ANTHRACNOSE

Gloeosporium spp.

Anthracnose is a common disease in the northern hardwood and oak/hickory forest type groups, as well as on ornamental trees. Light to moderate anthracnose damage was observed on dogwood trees in Rhode Island. Future problems are expected. Sycamore anthracnose was responsible for complete defoliation in the southeast and capitol district of New York, Bennington, and Windham Counties in Vermont and in Massachusetts. Trees had refoliated by mid-June, but they had tufted crowns and scattered shoot mortality. Two consecutive years of wet springs and summers are blamed for the outbreak. Anthracnose is also responsible for scattered browning on maples and oaks in Vermont and Rhode Island. Southern Vermont observed extensive anthracnose damage from a mid-August infection.

ARMILLARIA ROOT DISEASE/STILLWELL'S SYNDROME

Armillaria spp.

Armillaria root disease can affect several different species in all of the forest type groups. In southern Vermont, *Armillaria* is causing occasional dieback and mortality of conifers. Stillwell's syndrome is a condition on balsam fir resulting from severe spruce budworm defoliation and *Armillaria*. All of the dead trees that were examined were infected with species of *Armillaria*. Southern and central Hancock County in Maine showed a 500,000 acre increase in the syndrome, affecting 6.5 million acres. Scattered individual trees die with less than 1% of the fir affected. Stillwell's syndrome is stable in most of Maine except in the southeast where it is expected to continue for three to five more years.

BEECH BARK DISEASE/BEECH SCALE

Nectria coccinea var. faginata Cryptoccus fagisuga

Beech bark disease is found on American beech in the northern hardwood forest type group and is present throughout the New England/New York region. Frequency of scale populations are increasing. Various levels of severity, from uninfested to dead, were observed in Maine. Heavy damage on 1,691 acres was aerially mapped in the Northeast Kingdom in Vermont. Scattered dieback and chlorosis was observed in southern Vermont.

DIPLODIA TIP BLIGHT

Diplodia pinea

Diplodia is commonly found on plantations and ornamentals. For years, it has been prevalent on Martha's Vineyard, Massachusetts, causing high mortality in the red pine stands on the island. Heavy damage was observed on red pine ornamentals in Bristol, Vermont. Scattered damage occurred on a 15-year-old plantation in southern Vermont.

DUTCH ELM DISEASE

Ceratocystis ulmi

Dutch elm disease remains common throughout the region. American elm, a component of the elm/ash/red maple, northern hardwood, and oak/hickory forest type groups, as well as a common shade and ornamental tree, is very susceptible to the disease. Severity of the epidemic is dependent on the aggressiveness of the strain of *C. ulmi*, population of elm bark beetles, and individual resistance of elms. Aggressive strains of the disease are now predominant throughout most of North America and are quick to cause mortality. Maine reports many older elms which survived the initial wave of the disease are now becoming infected with these strains.

EUROPEAN LARCH CANKER

Lachnellula willkommii

European larch canker occurs primarily on larch and tamarack in the spruce/fir forest type group. The area of larch canker infection has remained constant at 6,500 acres along the Maine coast. No new towns were added to the quarantine area. Heavy infection has been observed at two epicenters, with light to moderate infection in the rest of the region.

HYPOXYLON CANKER

Hypoxylon spp.

Hypoxylon is most often found on aspen in the aspen/birch forest type group. The disease is common throughout northern Vermont and heavy damage was observed on quaking aspen in Rutland and Pittsford.

SCLERODERRIS CANKER

Gremmeniella abietina

Scleroderris canker is mainly found on red pine plantations in the white/red pine forest type group. Scattered infections in previously recorded sites were observed in Eustis, Maine. No new locations were identified in Vermont, although some recent infection could be found within the quarantined area.

WHITE PINE BLISTER RUST

Cronartium ribicola

Blister rust is commonly found on white pine in the white/red pine forest type group where the alternate hosts, *Ribes* spp., are present. The trend of the disease is static in Maine. Annual losses continue to be about $100,000. Scattered mortality occurred in Westminster, VT.

FOREST STRESSORS

DIEBACKS/DECLINES

Dieback and decline refers to a general loss of health for a particular species which cannot be attributed to one specific insect or pathogen. Diebacks are often the result of several biotic and abiotic factors working together. Common symptoms are slow, stunted, or distorted growth; brown or chlorotic foliage; dieback in twigs and branches; and tree mortality.

ASH DIEBACK/YELLOWS

White ash is present in the forest type groups of northern hardwood, elm/ash/red maple, oak/hickory, and aspen/birch. It is the species most commonly susceptible to dieback, with red and green ash affected to a lesser extent. Maine reports black ash as the predominantly affected species in that state. Dieback in ash is characterized by subnormal growth, stunted twigs, tufted foliage, and in advanced stages, epicormic sprouts, delaquescent branching, and witches' brooms. Mortality occurs one to several years after symptoms appear. Dieback may be caused by a variety of factors, but it is most often found in association with the mycoplasma-like organism (MLO) causing ash yellows. Other agents causing or intensifying symptoms may be drought, freezing, viruses, or fungal pathogens. In New York, ash dieback was reported statewide with severity ranging from light damage to complete stands dying. About 80% of the mortality was attributed to ash yellows, the remaining to unknown factors. High infection rates are expected to continue. Dieback and mortality continues to plague white ash throughout Massachusetts and southern Vermont. Severe dieback and mortality occurred on 1,500 acres of black ash in Aroostook County, Maine, particularly along streams and wet areas. Severity increased in 1990 and is expected to continue in 1991.

BIRCH DIEBACK

Dieback is found on birch in the aspen/birch, spruce/fir, and northern hardwoods forest type groups. In Maine, damage continued in the Rangley Lakes region on 34,300 acres and in Washington County on 49,400 acres. Symptoms of dieback were reported in the crowns of 75% of the white birch surveyed in the Rangley area and 94% in Washington County (based on basal area within stands). Mortality was 2% and 5%, respectively. Birch decline in Maine is expected to continue. In Vermont, dieback in birch continued at upper elevations in Windsor County but is improved throughout most of the southern area of the state. Declining populations of birch leaf miner have reduced the stress in birch stands.

MAPLE DECLINE

Sugar maple is a species of forest stands and sugarbushes, as well as an ornamental and shade tree. It is a major component of the northern hardwood forest type group and is a common associate of several other forest type groups. Occurring on 2,625,800 acres in Maine, sugar maple is monitored on 18 plots located throughout the western part of the state. In 1990, less than 10% crown dieback was found on these plots, which are part of the North American Maple Project (NAMP-see Forest Monitoring section). Maple stands in Vermont generally appeared healthier than in past years, probably due to higher levels of rainfall and minimal problems with defoliating pests. Damage did occur where stressing factors were present. Overtapping, hygrading, logging damage, improper planting, poor site selection, wounding, sapstreak, and thrips defoliation contributed to dieback in a few localized areas. Maple decline remains a concern, and monitoring of NAMP plots throughout the region will continue.

FOREST STRESSORS

ABIOTIC CONDITIONS

Abiotic stressors can affect any forest type in any season. These stressors include mechanical damage, drought, excess water, winter injury, frost injury, storm damage, and pollutants. Abiotic stressors can make trees more susceptible to damage from insect and disease attacks.

MECHANICAL WOUNDS

Ornamental maples with girdled roots, sugarbushes on shallow sites, and trees disturbed by grade changes or wounding developed dieback or died in Vermont.

HERBICIDE INJURY

Plantations, nurseries, and ornamental trees are commonly affected by herbicide applications. Herbicide injury was observed in several locations in southern Vermont. Pockets of mortality were caused by Roundup applications in a Douglas fir Christmas tree nursery. Dicamba injured ornamental spruce on a golf course. A variety of species were injured in a small nursery, and chlorosis on a white spruce plantation was caused by herbicide applications.

DROUGHT

Drought conditions from 1988 continue to affect trees in Vermont.

FROST INJURY

Frost injury was observed on maples at higher elevations in Mendon, Sherburne, Rupert, and Sunderland, VT. Balsam fir Christmas trees in Windham, VT, had light damage.

STORM DAMAGE

Snow damage from an early winter storm on November 10 caused heavy limb and tree breakage throughout northern Vermont, except for the Connecticut River and Lake Champlain valleys. Heavy winds following the storm continued to blow down trees. Pines and balsam fir were most heavily damaged. Fifteen acres of red pine in Waitsfield received 20% damage.

WINTER INJURY

Unusually cold temperatures before trees hardened off, in December of 1989, are blamed for winter injury on conifer ornamentals and Christmas tree plantations in Vermont and Maine. Nearly half of the plantations inspected in Vermont were affected, with moderate to heavy damage reported on 234 acres of mostly Scotch pine plantations. Light to moderate damage occurred on most conifer species in Maine with heavy damage on Scotch pine.

PROTECTION ACCOMPLISHMENTS

A cooperative effort was made in 1990 to suppress gypsy moth defoliation in Vermont. Cooperators were: Forest Health Protection, USDA Forest Service; Forest Resource Protection, Vermont Dept. of Forests, Parks, and Recreation; and the Vermont Dept. of Agriculture. A total of 11,237 acres were treated with Foray 48B (*Bacillus thuringiensis* var. kurstaki) in Chittenden and Addison Counties, including 3,202 acres on the Green Mountain National Forest. The undiluted pesticide was dispensed by fixed-wing aircraft at the rate of 24 BIU per acre. Larval development was 97% in the first and second instars and foliage expansion was 80%. Weather conditions were good and no precipitation occurred within 30 hours of treatment. The project had excellent results. Prior to treatment, defoliation averaged nine percent, and after, twelve percent. Unsprayed areas showed 52% defoliation. Egg mass counts in the treated area were much lower than counts from 1989, when there was no treatment. Treatment area counts were also substantially lower than untreated areas.

Another cooperative gypsy moth suppression project was between Forest Health Protection, USDA Forest Service and the Seneca Nation of Indians in New York. Dipel 8AE (*B. thuringiensis*) was aerially dispensed over 1900 acres in Erie County at the rate of 16 BIU per acre. Larval development was divided equally between first and second instar and foliage expansion was 40%. The application was undiluted and repeated after five days.

Various other suppression measures were undertaken by individual growers to protect their plantations, nurseries, ornamentals, and valuable woodlots. Christmas tree growers used Diazinon to combat balsam gall midge and balsam twig aphid. Both Dimilin and Lindane were used, with good results, to treat pine plantations for white pine weevil. Vermont reported aerial spraying of carbaryl to suppress pear thrips. Suffocants were used to treat ornamentals attacked by hemlock woolly adelgid. In an attempt to control white pine blister rust in Maine, about 6,000 acres of the alternate host, *Ribes* spp. were treated with the herbicide, Tordon RTU. Testing is being done on the use of the herbicide, Garlon. Maine also reported private projects of ground and aerial application of *B. thuringiensis* on 3,000 acres for gypsy moth suppression. In New York, pesticide spray applications were made to control pine false webworm, saddled prominent, forest tent caterpillar, and anthracnose.

Various alternative means of control were also reported. Timber salvage utilized trees damaged by spruce beetle and hemlock looper in Maine, and red pine scale and ash yellows in New York. Browntail moth winter nests were clipped in both Maine and Massachusetts and pheromone traps were deployed in Maine. Pheromone traps were also used to monitor spruce budworm, forest tent caterpillar, oak leaftier, and gypsy moth. Borax was recommended in Maine to prevent infection of annosus root rot in stumps. A quarantine area is still enforced for european larch canker in Maine and scleroderris canker in Vermont.

FOREST MONITORING

The increased awareness of stressors and human influences upon the forest ecosystems have resulted in the need to address concerns about forest health. Several forest monitoring projects have been underway in the east. The North American Sugar Maple Project, the Vermont Hardwood Survey, and New England Forest Health Monitoring are some of the projects focused on the New England/New York region.

Forest Health Monitoring

Forest Health Monitoring was implemented in the six New England states in 1990 in cooperation with the USDA Forest Service, US Environmental Protection Agency, and the six New England state Foresters. The New England Forest Health Monitoring project (NEFHM) is intended to be a long term effort with a major emphasis on detecting unexpected change from established baseline conditions. Specific objectives of NEFHM are to: 1) characterize forest conditions, 2) characterize potential forest stressors, 3) quantify changes in forest conditions, and 4) analyze the relationships between changes in forest conditions and potential forest stresses.

New England Forest Health Monitoring is based on the annual remeasurement of an extensive network of permanent locations, selected to correspond to a systematic sampling grid developed by the USEPA for their Environmental Monitoring and Assessment Program (EMAP). Measurements will be made and indicators characterized on a periodic basis; annually for those that change frequently (ie. foliar symptomatology) and on a four year or greater cycle for those that change less frequently (ie. diameter growth). In 1990, 263 permanent plots were established and measurements taken on growth and foliage symptomatology. Soil and foliar chemistry is expected to be implemented in the future.

The NEFHM plot sample corresponds closely to New England forest resource characteristics as reported by previous surveys. The crown rating data from open grown, dominant, and codominant trees indicate no pattern of major decline in any species. For many species, these data represent the first such crown condition measurements and exact interpretation is difficult. The full value of the data will be realized with the plot remeasurements in future years. The 1990 data established the baseline against which changes will be intensified in subsequent years. The status and impact from forest pests are also being quantified and will be overlayed with the data from the plot network.

For more information contact Margaret Miller-Weeks, US Forest Service, Forest Health Protection, Durham, New Hampshire.

North American Sugar Maple Decline Project

The North American Sugar Maple Decline Project (NAMP) was formed in 1987 to monitor sugar maple conditions, particularly in relation to pollution and stand management intensity. The Canadian and United States federal governments, as well as seven states and four provinces cooperate in the project and provide the data. Objectives of the survey are to determine: 1) the rate of change in sugar maple tree condition ratings, 2) if the rate of change in sugar maple tree condition ratings are related to: a) various levels of sulfate and wet deposition, b) sugar bushes on undisturbed forest, and c) various levels of initial stand decline conditions, and 3) the possible causes of sugar maple decline and the geographical relationships between potential causes and extent of decline.

Plots were established in 1988 and data has been collected from 1988-1990. The U.S. plots are located in Maine, Massachusetts, Michigan, New Hampshire, New York, Vermont, and Wisconsin. The 1988 and 1989 data has been analyzed by D. C. Allen and C. Barnett, SUNY College Of Environmental Science and Forestry, Syracuse, NY (1990 data is currently being analyzed). In 1989, more than 90% of the 11,000 sugar maples were rated with less than 15% crown dieback, a slight improvement over the 1988 data. Sugar bushes had slightly fewer trees in the low dieback classes than did the undisturbed forest stands for both years. Foliage transparency increased slightly, especially in stands exposed to low sulfate wet deposition. Data shows that annual fluctuations in crown dieback and foliage transparency occur, but more data is needed before any trends can be determined.

Data will continue to be collected and reports will be published annually. More information is available from Imants Millers, US Forest Service, Forest Health Protection, Durham, New Hampshire.

Vermont Hardwood Resurvey

A hardwood resurvey was begun in 1990 with the acquisition and interpretation of aerial photography. This is a follow-up survey of the Vermont Hardwood survey which was done in 1985/1986 using aerial photo interpretation and ground data. The objectives of the 1990/1991 survey are to evaluate Vermont's hardwood forest health and to compare the results with the 1985/1986 baseline survey to determine trend in tree condition.

Aerial photos were taken of the same areas that were flown in 1985. Photo interpretation was done by the remote sensing group at the US Forest Service, Forest Health Protection, Durham, New Hampshire. Plots that were established in 1986 will be revisited in the summer of 1991. Analysis of both photo interpretation and field data will be done by the US Forest Service, Method Applications Group (MAG), Fort Collins, Colorado. A report of the findings will be published in 1992. More information can be obtained from Ron Kelley, Vermont Department of Forest and Parks, Morrisville, Vermont.

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